2011 Military Health System Conference

Air Force Medical Modeling and Simulation

Bringing Virtual Reality to Reality

The Quadruple Aim: Working Together, Achieving Success

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26 January 2011

Medical Modernization Division
Headquarters, Air Education & Training Command

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Overview

- Program Review

- Medical and Simulation Training Limitations

- AFMS Cloud Architecture

- Projects and Resourcing

- DoD MM&ST Consortium

- Strategic Partnerships

- San Antonio Medical Simulation CoE

Mission

Integrate Simulation and Emerging Technologies into Education, Training and Sustainment Platforms

Vision

Build a Distributed Simulation Network, Create Centers of Excellence, and Exploit Technological Innovation

Battlefield Trauma, Critical Care Air Transport, In Garrison Care, Patient Safety, Humanitarian Missions, CBRN, Disaster, Homeland Defense and Pandemic Response

Targeted Training Areas

- Combat Casualty Care
- Critical Care Air Transport/Aeromedical Evacuation
- Patient Safety & Team Training
- Currency, Competency, Sustainment
- Graduate Medical Education
- Nurse and Allied Health
- Natural Disaster & Homeland Security
- Pandemic Response
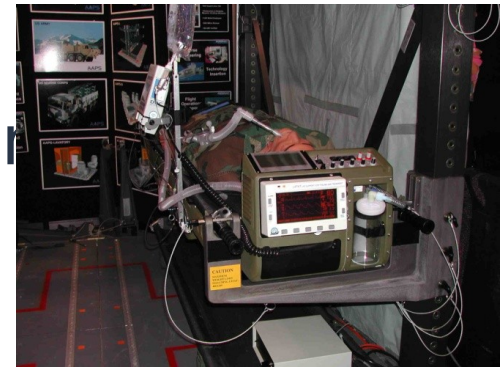
A Call for Change

...reventable medical errors among the leading causes of death in the United State...
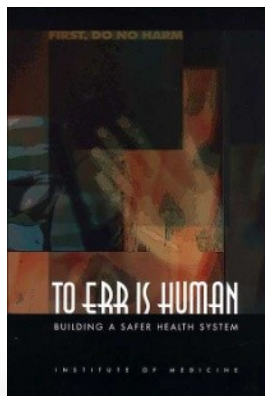
November 1999
I N S T I T U T E OF M E D I C I N E
Shaping the Future for Health

TO ERR IS HUMAN:
BUILDING A SAFER HEALTH SYSTEM
Recommendation 8.1:

"Patient safety programs should… establish interdisciplinary team training programs for providers that incorporate proven methods of team training, such as simulation."

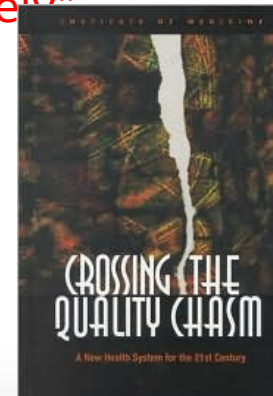March 2001
I N S T I T U T E OF M E D I C I N E
Shaping the Future for Health
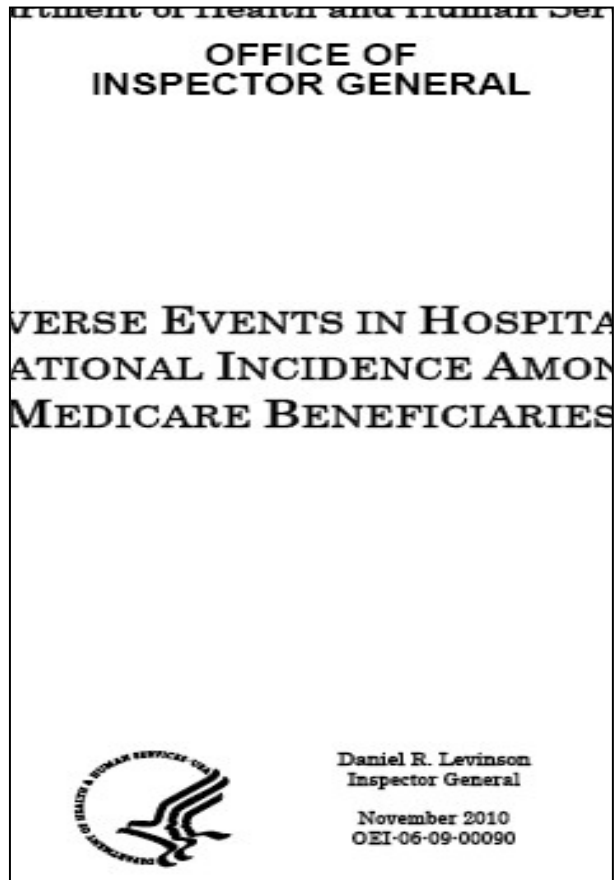
CROSSING THE QUALITY CHASM:
A NEW HEALTH SYSTEM FOR THE
21ST CENTURY

"Faced with such rapid changes, the nation's health care delivery system has fallen far short in its ability to translate knowledge into practice and to apply new technology safely and appropriately."

One Decade Later...

OFFICE OF
INSPECTOR GENERAL

VERSE EVENTS IN HOSPITA
ATIONAL INCIDENCE AMON
MEDICARE BENEFICIARIES

Daniel R. Levinson
Inspector General

November 2010
OEI-06-09-00090

- 13.5% Medicare inpatients have at least 1 unexpected adverse event
  - 1.6M harmed per year
  - 180,000 fatalities per year

- 44% "clearly or likely preventable"
  - 707,000 harmed per year
  - 79,000 fatalities per year

Over $4 billion added to Medicare health care cost!

One Decade Later...

A July Spike in Fatal Medication Errors: A Possible Effect of New Medical Residents

David P. Phillips, PhD[1] and Gwendolyn E. C. Barker, BA[2]

[1]Department of Sociology, University of California at San Diego, La Jolla, CA, USA; [2]School of Public Health, University of California at Los
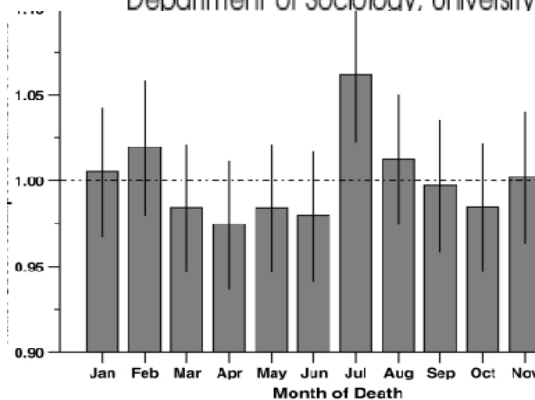
Figure 1

...tio of observed to expected deaths for inpatient medication errors by m...
...ited States, 1979-2006 (with 95% confidence intervals). Unless otherw...
...or bars in Figure 1 and in subsequent figures were determined using...
...proximation.46

...uly Spike in Fatal Medication Errors: A Possible Effect of New Medical ...
...en Intern Med. 2010 August;25(8):774-779.

J Gen Intern Med. 2010
Aug;25(8):774-9

- 10% increase inpatient deaths from medication errors in counties with teaching hospitals

- Death rate NOT decreased despite patient safety concerns and decrease in resident work hours (cut in 2003)

Surgical Workload (Comparison to US Trauma Center*)

US Level One Trauma Center	332 EMDG/AFTH Balad
▪ ~2000-7500 admission/year	▪ ~8000 admissions/year
▪ <30% penetrating trauma	▪ >90% penetrating trauma
▪ High velocity GSW – rare	▪ High velocity GSW – rule
▪ Blast injury – rare	▪ Blast injury – very common
▪ <10% trauma pts need surgery	▪ >80% trauma pts need surgery
▪ Most pts need one procedure/one surgeon	▪ Majority pts require multiple procedures and specialists
▪ Multiple casualty event – rare	▪ Mass casualty event – common

US trauma care unlike battlefield trauma. Medics must combine hands-on with simulation training to achieve and maintain currency and competency

* **May 2007**

"On-The-Job-Training" Not An Option

Central Program Office

- Program established Jan 2008
- Developed/executed CONOPS, strategic plan
- ID requirements, develop standard curricula
- Manage resources: Staff, equipment, support
- New technology development
- Program for sustainment

Central Program Office

- Assets $59.3M, 48.5 FTEs 80 sites worldwide*
- "DoD Center of Excellence" by the ASD/HA
- Lead Service, DoD MM&S Training Consortium
- Lead Service, Joint Technology Coordinating Group-1 Medical Simulation subgroup
- USAF SG designated SPC vs METTAR for medical simulation E&T

"Hub & Spoke" Simulation Network

Facilities grouped into 4-tiered system based on training requirements and simulation

Category	Characteristics
TIER 1: Centers of Excellence	Curriculum and scenario development, Mentor/train Tier 2 sites, qualified instructors, full-time simulation staff, training GME/RSV/Phase II/Annual/Critical Care/Formal Courses
TIER 2: Core Simulation Programs	Execute training and disseminate curriculum/scenarios to Tier 3 sites; Mentor Tier 3 sites, qualified instructors and part-time support staff, training GME/RSV/Phase II/Annual/etc
TIER 3: Regional Simulation Programs	Execute simulation training for assigned staff, additional duty simulation staff, training RSV/Annual
TIER 4: Program Initiation or Drawdown	Execute RSV, Life Support Training as needed; utilize local hospitals or the VA to support training

Tier I Site Selections

- Wilford Hall *

- Keesler *

- Travis *

- C-STARS Saint Louis

- C-STARS Baltimore

- C-STARS Cincinnati

- USAFSAM - EMEDS *

- Lakenheath UK

- National Capitol Area Simulation Center (USUHS)

- Defense Medical Readiness Training Institute (DMR~~

  * *Simulation Operator Course*

AF Simulation Regions

- Travis Region
- USAFSAM
- Cincinnat.
- Lackland Region
- St. Louis
- Baltimore
- USHUS
- KEESLER
- PACAF/USAFE

Luke, Nellis, WP

Luke AFB, AZ
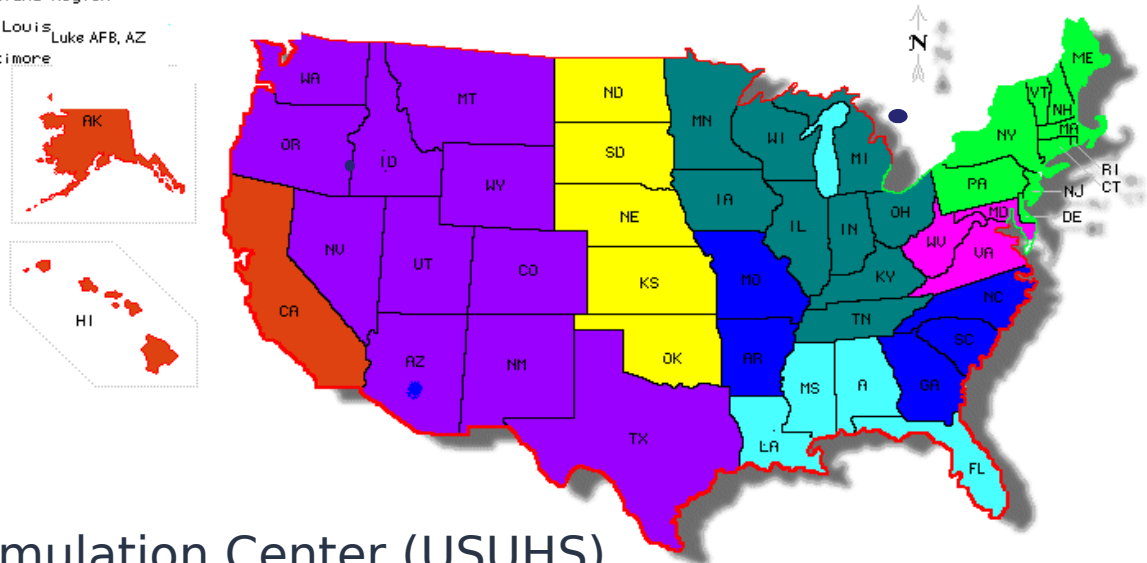
Tier 1 Organizational Structure
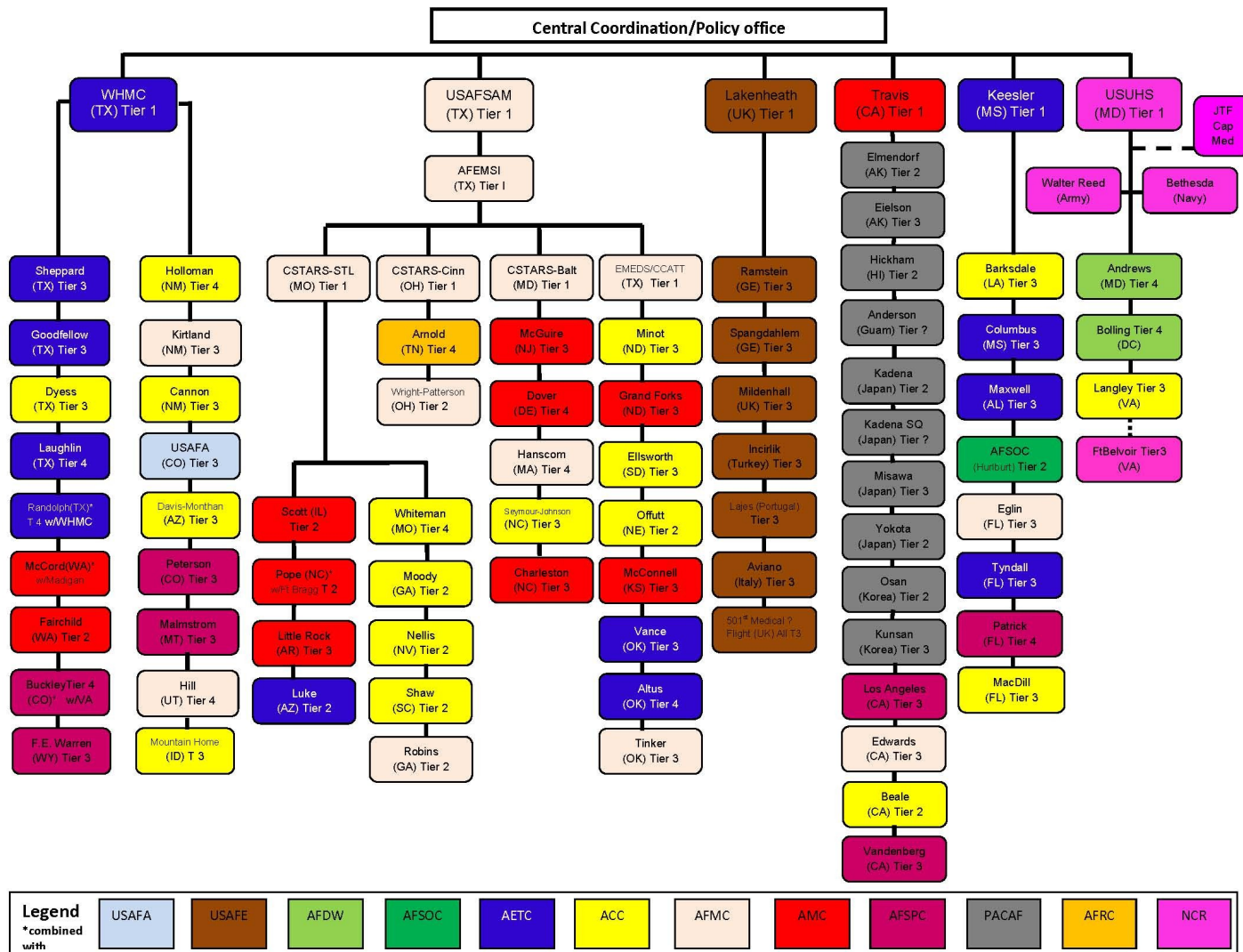
Simulation Training Network

Central Program Office

Tier 1 — Students — Tier 2 — Students — Tier 3

Knowledge Sharing

Standardized Curriculum and Scenarios
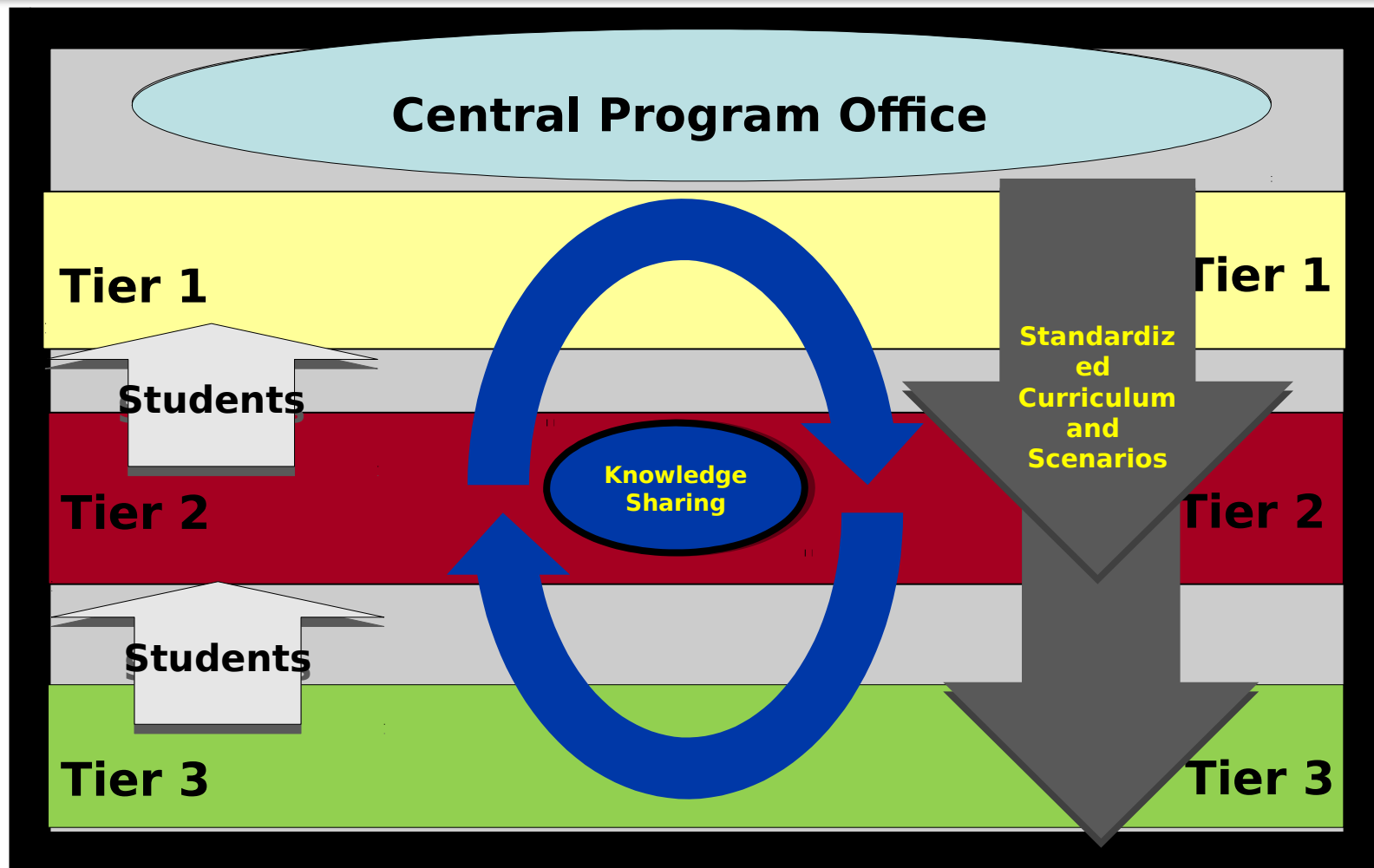
Dynamic Network for information Sharing

Aligning Currency & Training

- In the last 10 years, over 50% of 522 U.S. airline accident fatalities linked to simulation training errors

- *"Far easier than in the real world"*

- Poor training = catastrophic mistakes

- <u>Simulation is only as good as the data, knowledge and expertise used to train</u>

Simulator flaws tied to airline crashes

Flight training cited in half of fatalities

By Alan Levin
USA TODAY

Flaws in flight simulator training helped trigger some of the worst airline accidents in the past decade, according to a USA TODAY analysis of federal accident records.

More than half of the 522 fatalities in U.S. airline accidents since 2000 have been linked to problems with simulators, devices that are used nearly universally to train the nation's airline pilots, the records show.

Simulator training is credited with saving thousands of lives. But the problem, according to National Transportation Safety Board (NTSB) case files and safety experts, is that in rare but critical instances they can trick pilots into habits that lead to catastrophic mistakes.

Last month, the NTSB blamed deficient simulator training in part for the Dec. 20, 2008, crash of a Continental Airlines jet in Denver.

The Boeing 737-500 skidded off a runway at high speed and burst into flames because of the

**USA TODAY
31 Aug
2010**

Medical Training Limitations

- Curricula and training materials not standardized
- Quality variable and inconsistent in/out MTF
  - # patients, surgical cases, staff experience and availability
- Lack validation of skill acquisition, performance
  - Metrics not established, tracked or archived
- Measures of quality and competency flawed?
  - Exams, # cases, errors, complications, malpractice
- No enterprise IT architecture or interoperability
  - Multiple info sources, servers, databases, passwords
  - Difficult to access/unknown, local servers, no mobile app

Simulation Training Limitations

- Lack uniform use of standard tools
- Quality variable - Instructor SME, know simulation?
- Not formally integrated into curriculum
- Poor for surgery, invasive procedures, live tissue
- High student-instructor ratio
  - Limits individual instruction and # didactic sessions
- Low throughput
  - Set-up/breakdown, space availability

- Feedback inconsistent (verbal vs taped)

Health Care Innovation Surge

- Current health care system is unsustainable
- Advances in treating disease and trauma
- Technology innovation has changed how we live
- Little application to improve health system efficiency
- Rising health costs push responsibility onto patients
- New generation of computer-savvy doctors/patients
- Ubiquity of high-speed Internet, mobile devices
- Influx of innovation from technology entrepreneurs
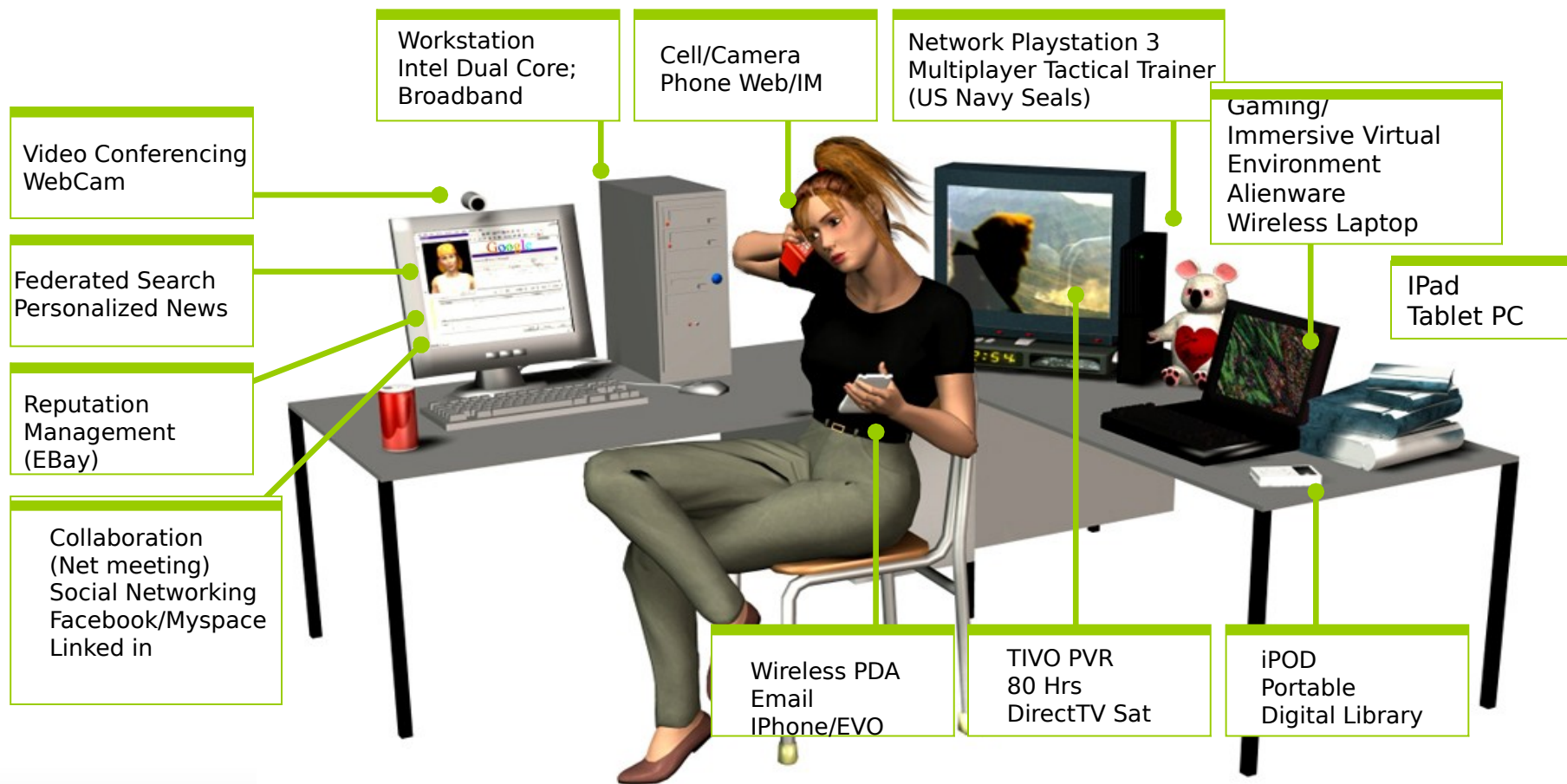- DoD and the Federal Government forces for change

GE and Intel team up to develop Telehealth gadgets for chronic disease management, independent living, and assistive technologies

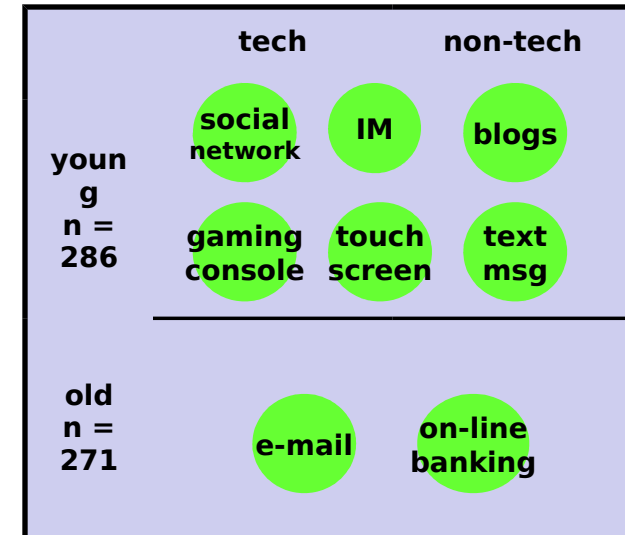# The Future Airman

Today's Cyber Teenager = Tomorrow's Airman

Workstation
Intel Dual Core;
Broadband

Cell/Camera
Phone Web/IM

Network Playstation 3
Multiplayer Tactical Trainer
(US Navy Seals)

Gaming/
Immersive Virtual
Environment
Alienware
Wireless Laptop

Video Conferencing
WebCam

Federated Search
Personalized News

IPad
Tablet PC

Reputation
Management
(EBay)

Collaboration
(Net meeting)
Social Networking
Facebook/Myspace
Linked in

Wireless PDA
Email
IPhone/EVO

TIVO PVR
80 Hrs
DirectTV Sat

iPOD
Portable
Digital Library

Digital Natives

Future Learning Survey Airmen & Technology*

Young vs Old: Statistical difference in use of technology

- Strategy for E+T technology
- Knowledge, attitudes, views
  - Legacy: PCs, cell-phones, e-mail
  - Newer: virtual worlds, gaming
- 557 participants in two categories
  - *Age: Young (18-21)* 286, Old (22+) 271
  - Excluded (*40+*)

	tech		non-tech
young n = 286	social network	IM	blogs
	gaming console	touch screen	text msg
old n = 271	e-mail		on-line banking

- 93% - view of bases online beneficial
- 60% - virtual operational exercises online enhance readiness
- 58% - avatars could be effective mentors
- 65% - online gaming provides encouragement to join military

AIR FORCE MEDICAL SERVICE

Overarching Strategy for Enterprise Technology Service Delivery

MEDICAL 3

1

AFMMST

HAPTICS 6

4

LEARNING

MEDICAL MANAGEMENT SYSTEM

GAMING

Performance Metrics

SIMULATION

MEDICAL VIRTUAL ENVIRONMENTS 2

Virtual Iraq & Afghanistan

DISTRIBUTED SIMULATION

HUMAN PATIENT

CYBRARY

LIVE TISSUE REPLACEMENT 5

MEDICAL MODELING & SIMULATION

Cloud Computing: Software as a Service (SAAS)

- SAAS applications managed from a central server vs on site
- Enables remote access to applications via a web browser
- Eliminates the need to download patches and upgrades
- "Turn-key" access to software and services
- Multiple users access the same app (multiplayer gaming, mobile)
- Affordable, pay-as-you-go, à la carte menu of software
- Eliminates IT infrastructure and software sustainment costs
- Reduces the number of data centers, IT systems, contractors
- Alternative to investing in hardware

Focus shifts from managing IT infrastructure to strategic projects

DoD and Federal Government Technology Alignment

- Cloud computing a new business model for DoD and federal government

- Access to emerging technology and high value data

- Cost savings and greater efficiency
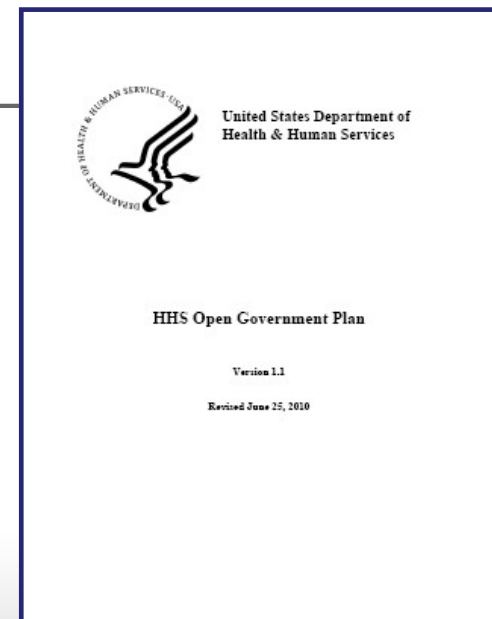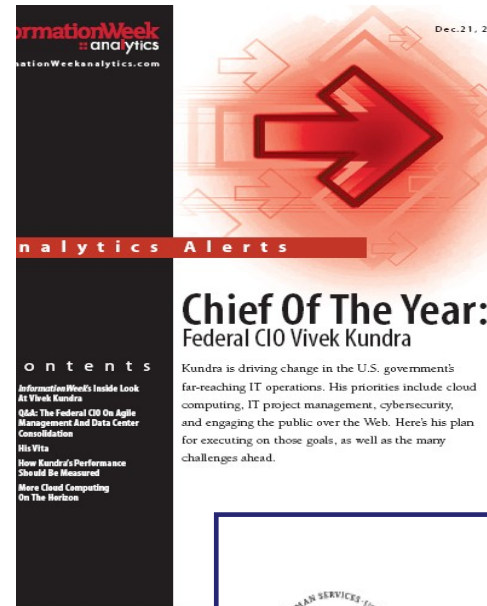
AFMMST Portal 360°

The Air Force Medical Modeling & Simulation Training Portal

VR Medical Training Online

- Web-based Virtual Reality Medical Training Portal for AFMS
- AFMS CBTs Online
- AFSC Specific Training
- Online Communities
- CAC Enabled
- Mobile Device Ready

Project Integrations

- Medical Training via Gaming Simulation
- Virtual Hospitals
- Virtual Sick-Call Training
- Haptics Technology
- LMS Integration
- Reports/Transcripts
- Web-Teleheath SimTool
- Medical Cybrary (docs/blogs, DBs)

Cloud Computing Strategy

- DoD Hosting Center
- Hosted Microsoft SharePoint 2010
- Network Security
- Managed Bandwidth
- IA Compliance
- Enterprise Storage Solution (SAN)
- Live Chat Support
- Virtualization

Strategic Partnerships

- CSC-A, CSC-N, USUHS
- Army RDECOM/STTC
- Air Force (Line/AETC)
- UCF Medical School
- Texas A&M (Pulse)
- TATRC, MHS, OASD/HA, VA
- OSD/DDR&E
- PEO-STRI
- METC
- AMEDD C &S
- MS/MSTC/BCTC

4th Quarter FY 2010
- Requirements Process
- Funding Allocated
- Staffing Acquisitions
- Strategy Development
- Partner Evaluations

1st Quarter FY 2011
- Infrastructure Acquisitions
- AFMMST Portal Devt
- Content Mgmt
- Hardware Setup

2nd Quarter FY 2011
- Development
- IA Process
- Project Integrations
- Online CBTs

3rd Quarter FY 2011
- Virtual Hospitals
- Medical Gaming
- Web-Telehealth
- Video Library
- Cybrary, Blogs

4th Quarter FY 2011
- Achieve IOC
- Continued Development
- Ongoing Sustainment

New Technology via AFMS Cloud

- AFSC and UTC specific training
- Virtual Hospital/EMEDS/C-17
- Virtual Medical Campus
  - Staff and Patient Education
- Medical Gaming – single/multi
- Cybrary, Professional Blog, CoPs
- Mobile application ready
- Web-based Education & Training System
- Defense Connect Online
- Center for Excellence in Multimedia

Virtual Iraq
& Virtual
Afghanistan
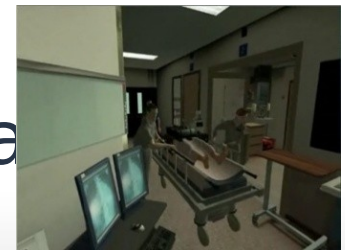
Knowledge Management Strategy

- Knowledge Management
  - Overarching Framework
  - Data tracking (performance metrics)
  - Enables archiving/historical documentation
  - Facilitates knowledge sharing

Knowledge Base

- Continuous Learning
  - Recruitment through retirement
  - Integration of learning and ops
  - Training, education, experiential learning

- Precision Learning
  - Persistent environment (24/7 access)
  - Tailored to individual styles and needs
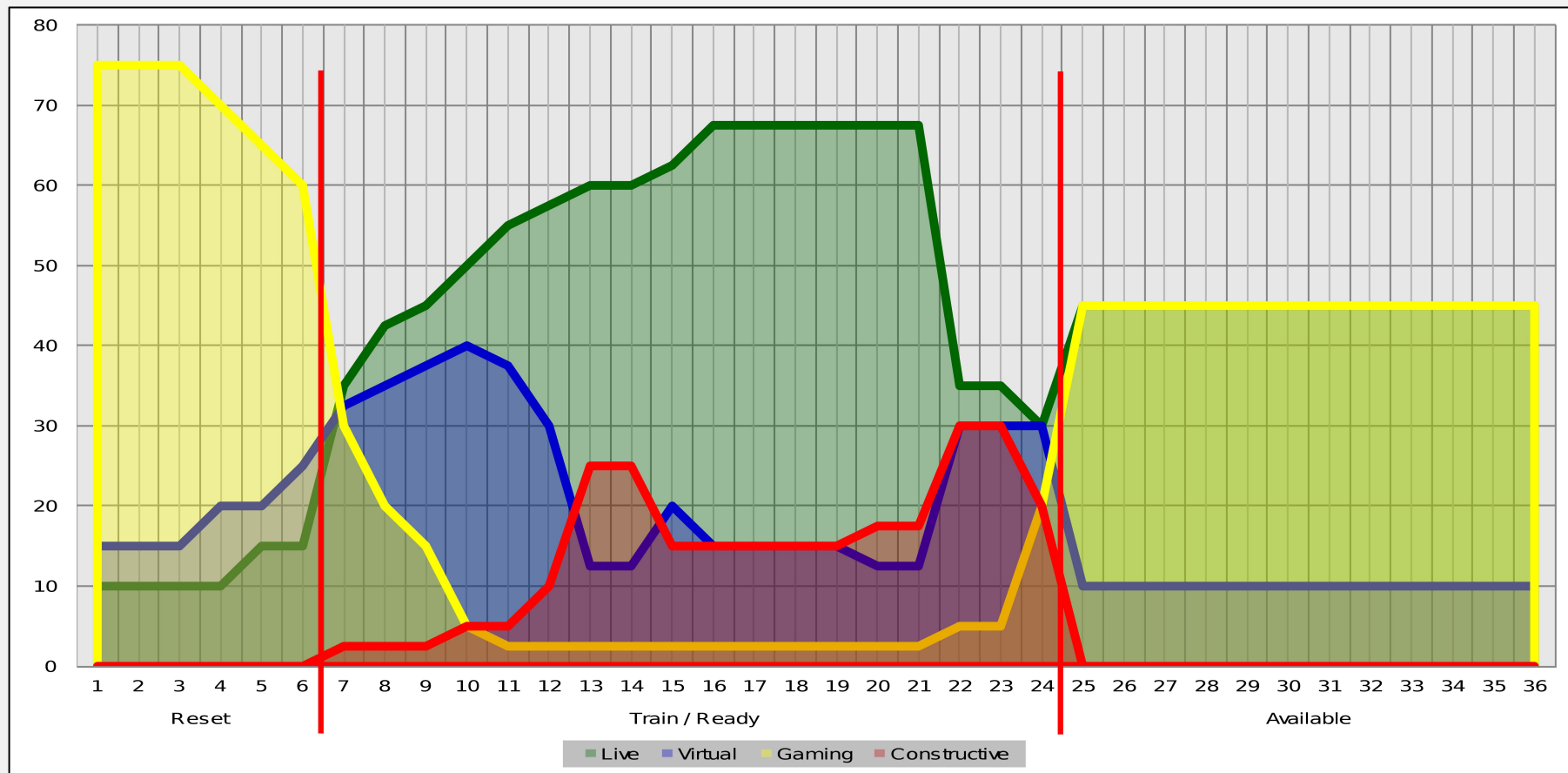
Standardized knowledge-centric framework

...tandard framework that is <u>knowledge-centric</u> not network-centr...

Blended Learning by Environment

Training by environment across ARFORGEN

Current Program

Aeromedical Evacuation C-17 Virtual Walkthrough

Image courtesy of Dorothy E Buckholdt Director, Advanced Distributed Learning USAF School of Aerospace Medicine
210-536-4671 Dorothy.Buckholdt@brooks.af.mil

USUHS and AFMS Research & Development Partnership

- USUHS conducts USAF medical simulation training

- USAF R+D Asset
    - PA Catheter Simulator
    - VR Cricothyroidotomy Simulator
    - VR Head Trauma Trainer
    - Wide Area Virtual Environment

New Technology Development

- **Congressional Projects**
  - Natural Disaster Response Gaming Simulation ($3.44M)
  - Military Trauma Training ($708K) CSTARS Baltimore/UMMC
  - Spec Force Med Training – PJ/Combat Control Team ($2.9M)
- **Small Business Innovation Research ($300K)**
  - Medical Gaming +/- haptics - virtual surgery/invasive procedures
  - Virtual Environments - Hospital/EMEDS/CCATT
  - Synthetic Tissue to augment/replace live tissue – 1st in DoD
- **HQ AETC Advanced Tech Learning Demo ($400K)**
  - 4N0X1 Phase 1 METC Training Gaming Simulations
- **Defense Medical Research & Development (ROI)**
  - Tri Service Medical Simulation & Trng Curriculum Development and Validation Research ($5.5M) AF SGR is PI

Requirement	In-Place?	Initial Funding In-Place?	Partnership	ETA	AFMMST Portal & Cloud Strategy?
Medical Modeling and Simulation Training Portal (AFMMST Portal)	Yes	Yes	AETC/SGR USDA	July 2011	Yes
Virtual Reality Medical Gaming	Yes	Yes	RDECOM Texas A&M Univ	Mar 2011	Yes
Cloud Computing Hosting Partners	Yes	Yes	UCF RDECOM	Dec 2010	Yes
AFSC Based Medical Games	Yes	Yes	AETC/SGR RDECOM Mountain Top Tech	Jun 2011	Yes
Medical Scenarios VR Based Learning	Yes	Yes	AETC/SG RDECOM	Apr 2011	Yes
LMS Integration	Yes	No	AETC	TBD	Yes
AFMS Virtual World	Yes	Yes	RDECOM AETC	Jun 2011	Yes
Online TeleHealth VR Tools	Yes	Yes	SPAWAR	May 2011	Yes
Online Cybrary (Virtual Medical Research & Learning Lab)	Yes	Yes	AETC/SGR DKO	Apr 2011	Yes
AF Medical SME Online Communities	Yes	Yes	AETC/SGR DKO	Jun 2011	Yes
VR Training of Critical Medical Apps (AHLTA, TMIP, etc)	Yes	Yes	AETC/SGR	Mar 2011	Yes
Status of Emerging Technologies (Haptics, Live Tissue Replacement, Virtual	Yes	Yes	AETC/SGR	Dec	Yes

Bringing "Virtual Reality" to "Reality"

Reach the Summit by October 2012

HIGHEST RISK / LEAST EFFECTIVE STRATEGY
- Medical Gaming Developed for Each Service Branch
- Hardware & VR Games Installed on Base LAN
- Game Enhancements / Updates Mailed to Customers
- Lengthy DIACAP Process Per Game
- From Requirements to Time to Deploy is Very Long

MODERATE RISK / LIMITED SUCCESS STRATEGY
- Stand-Alone PCs & VR Med Games at MTFs
- Too Many Users vs. Limited Computers
- Expensive, Not Practical, Accessibility Issues
- Local Hardware/Software Support Required

MINIMUM RISK / HIGH PROBABILITY OF SUCCESS
- Tri-Service Med VR Games Hosted (Cloud)
- Centralized Mgmt, Updates, DIACAP, Enhancement
- Rapid Availability of Med Training via Web
- No Local Hardware/Software to Maintain/Refresh
- Services Leverage from Each Other
- Centralized Metrics, Feed to TTMS, LMS etc
- Subscription "A La Carte" Service to AFMS
- Lower Costs, Rapid Deployment, Joint Med Approach

LMS Feed -

AFSC VR Based Training -

Virtual Hospitals -

Integrate VR Worlds -

"CyberSimulation"-

Med Game Integration -

Cloud Computing -

AFMMST Portal -

Funding Pipeline -

AFMS Requirements -

Lethal Route

Very Risky Route

3

2

1

Highest Probability for Success

DoD Medical Modeling & Simulation Training Consortium

- Develop Joint requirements and standardized curricula
- Create DoD medical training platforms, exercises
- DoD research and multicenter validation studies
- Build "The DoD Medical Cloud"
- Joint technology development
  – AFMM&S CIO imbedded with Army RDECOM/STTC
  – RDECOM changed business model to adopt the AF cloud strategy
  – ECS Corpsman trauma medical game adapted to AF req's/scenarios
  – Texas A&M and CSC-N– Pulse
  – NCA Sim Center USUHS Wide Area Virtual Environment– to AFMS

WAVE
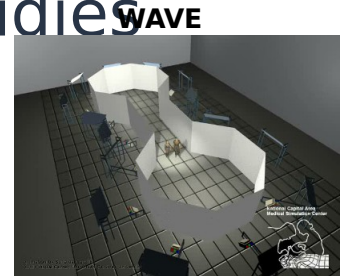
Immersive Virtual Environment

DoD Medical Modeling & Simulation Training Consortium

DoD MM&S Partnerships

- AFSOC A5Z (Pararescue)
- AMEDD C+S EMS/MSTC
- METC
- CSC-A, CSC-N
- USMC TECOM
- OASD(HA)TMA
- OSD/DDR&E – ULAMETJAT
  - JTCG-1, JPC-1 (research)
- NCA Medical Simulation Center USUHS
- BAMC

Other Strategic Partnerships

- CEMM
- AMEDD C+S BCTC – Battle Combat Training Center
- RDECOM/STTC
- University of Central Florida
- PEOSTRI
- DMRTI
- TATRC
- HQ AETC CC
- American College of Surgeons
- USC Institute for Creative Technologies
- UC Davis

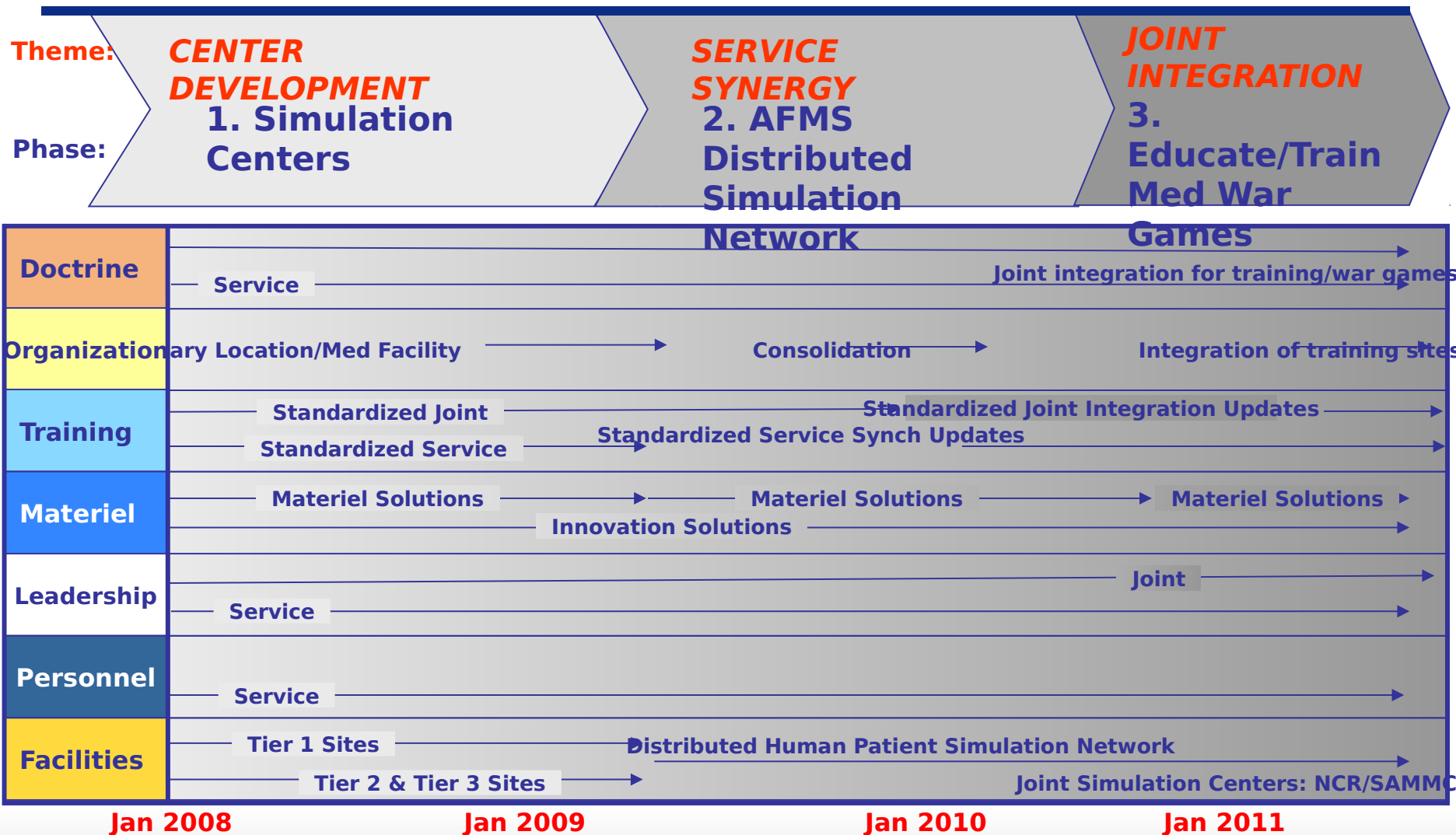# San Antonio Medical Simulation Center of Excellence

- DoD, Academia, Federal, State, Industry partners

- Assessed Joint training, space, staff req's

- Location?
  - 27.5K sq ft space close to Ft Sam Houston
  - New MILCON vs existing building refurbishment

- Resourcing and Sustainment
  - Budget, manpower, equipment
  - How do we insert, new technology?

Liu A, Bowyer M, NCA Simulation Center USUHS

Strategic Roadmap

Theme:	*CENTER DEVELOPMENT*	*SERVICE SYNERGY*	*JOINT INTEGRATION*
Phase:	1. Simulation Centers	2. AFMS Distributed Simulation Network	3. Educate/Train Med War Games

Doctrine	Service →		Joint integration for training/war games →
Organization	ary Location/Med Facility →	Consolidation →	Integration of training sites →
Training	Standardized Joint → Standardized Service →	Standardized Service Synch Updates →	Standardized Joint Integration Updates →
Materiel	Materiel Solutions → Innovation Solutions →	Materiel Solutions →	Materiel Solutions →
Leadership	Service →		Joint →
Personnel	Service →		
Facilities	Tier 1 Sites → Tier 2 & Tier 3 Sites →	Distributed Human Patient Simulation Network →	Joint Simulation Centers: NCR/SAMMC

Jan 2008   **Jan 2009**   **Jan 2010**   **Jan 2011**

Contact Info

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